

WHAT IS CLAIMED IS:

Sub 927 1. An imaging device for imaging radiation, said
 2 imaging device comprising a semiconductor substrate
 3 including an array of detector cells which generate charge
 4 in response to incident radiation and a corresponding
 5 readout semiconductor substrate including an array of
 6 readout cells, said readout cells being connected to
 7 corresponding detector cells by low temperature solder
 8 bumps.

1 2. The imaging device of claim 1 wherein said
 2 solder bumps comprise solder having a melting point under
 3 180°C.

1 3. The imaging device of claim 1 wherein said
 2 solder bumps comprise solder having a melting point under
 3 120°C.

1 4. The imaging device of claim 1 wherein said
 2 solder bumps comprise solder having a melting point under
 3 100°C.

1 5. The imaging device of claim 1 wherein said
 2 solder bumps comprise lead-tin based solder having a
 3 melting point below that of eutectic lead-tin solder.

1 6. The imaging device of claim 1 wherein said
 2 solder bumps comprise solder including Bi, Pb, and Sn.

1 7. The imaging device of claim 1 wherein said

1 14. An imaging system comprising:
2 an imaging device for imaging radiation, said imaging
3 device comprising an array of detectors which
4 generate charge in response to incident
5 radiation and an array of readout devices

9 control electronics operably coupled to said imaging
10 device for controlling reading by said readout
11 devices and processing output from said readout
12 devices; and

1 15. The imaging system of claim ~~14~~¹⁵ wherein each of
2 said detectors is a detector cell on a semiconductor
3 substrate.

1 16. The imaging system of claim ~~14~~ wherein each of
2 said readout devices is a readout cell on a next
3 semiconductor substrate.

1 17. The imaging system of claim 14 wherein said
2 control electronics comprise analog to digital converters.

1 ~~18.~~ The imaging system of claim ~~17~~, wherein said
2 control electronics further comprise data reduction
3 processors.

1 947 19. A method of manufacturing an imaging device
2 comprising a detector semiconductor substrate including an
3 array of detector cells for generating charge in response
4 to incident radiation and a readout semiconductor
5 substrate including an array of readout cells, one of said

6 detector cells and one of said readout cells forming an
7 image cell, said method comprising:

8 applying low temperature solder bumps to one of said
9 substrates at positions corresponding to said
10 image cells;

11 aligning respective readout and detector cells to
12 each other; and

13 connecting said detector and said readout cells by
14 the application of heat to said low temperature
15 solder bumps.

1 20. The method of claim ¹⁸~~19~~ wherein said solder bumps
2 are applied to said readout substrate at positions
3 corresponding to said readout cells.

1 21. The method of claim ¹⁸~~19~~ wherein said solder bumps
2 are applied to said readout substrate at positions
3 corresponding to said readout cells and to said detector
4 substrate at positions corresponding to said detector
5 cells.

1 22. The method of claim ¹⁸~~19~~ wherein said solder bumps
2 comprise solder having a melting point under 180°C.

1 23. The method of claim ¹⁸~~19~~ wherein said solder bumps
2 comprise solder having a melting point under 120°C.

1 24. The method of claim ¹⁸~~19~~ wherein said solder bumps
2 comprise solder having a melting point under 100°C.

1 25. The method of claim ¹⁸~~19~~ wherein said solder bumps

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1 26. The method of claim ~~19~~¹⁸ wherein said solder bumps
2 comprise a solder alloy of approximately 52 percent Bi,
3 approximately 32 percent Pb, and approximately 16 percent
4 Sn.

1 28. The method of claim ~~19~~¹⁸ wherein said solder bumps
2 comprise solder comprised of Bi and Sn and between 1 and
3 75 percent Pb.

1 30. The method of claim ~~19~~¹⁸ wherein said solder bumps
2 comprise a solder alloy including at least one of In, Cd,
3 Ga, Zn, Ag or Au.

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